Point Intercept (PO)

Sampling Method

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SUMMARY

The FIREMON Point Intercept (PO) method is used to assess changes in plant species cover or ground cover for a macroplot. This method uses a narrow diameter sampling pole or sampling pins, placed at systematic intervals along line transects to sample within plot variation and quantify statistically valid changes in plant species cover and height over time. Plant species or ground cover classes that touch the pin are recorded as "hits" along a transect. Percent cover is calculated by dividing the number of hits for each plant species or ground cover class by the total number of points along a transect. This method is primarily suited for vegetation types less than 3 ft (1 m) in height and is particularly useful for recording ground cover.

INTRODUCTION

The Point Intercept (PO) method is designed to sample within-plot variation and quantify changes in plant species cover and height, and/or ground cover over time. This method uses transects located within the macroplot. First, a baseline is established from which to orient the transects, then transects are placed randomly along the baseline. Characteristics—such as transect length, number of transects, and number of points per transect—are recorded about the general sample design. A sampling pole or sampling pins are systematically lowered along each transect and "hits" are tallied when contact is made with a plant species or ground cover class. Percent cover is calculated as the number of hits for each plant species or ground cover class divided by the total number of points per transect. Height is also recorded for each plant species along the transect.

This method is primarily used when managers want to monitor changes in plant species cover and height or ground cover and is best suited for sampling ground cover and grasses, forbs, and shrubs less than 3 ft (1 m) in height. The Point Intercept method works well for fine textured herbaceous communities, fine leaved plant species, and species with open canopies (pastures, dense grasslands, and wet meadows), which can be more difficult to estimate with the Line Intercept (LI) method. It provides a more objective estimate of cover than the ocular estimates used in the Cover/Frequency (CF) sampling method. It can be difficult to detect rare plants with the PO method unless many points are used for sampling. Point intercept sampling requires many points to sample rare species (200 points to sample at 0.5 percent cover). Quadrats sample more area and have a greater chance of detecting rare species. If rare plant species are of interest the CF or RS methods are preferred because it is more effective to sample rare

species using quadrats or by marking individual plants, than with points or lines. We suggest you use the PO method if you are primarily interested in monitoring changes in ground cover. The PO method may be used in conjunction with the CF method to sample ground cover by using the CF sampling quadrat as a point frame.

The Point Intercept method is considered one of the most objective ways to sample cover (Bonham 1989). The observer needs to decide only whether a point intercepts a plant species or the ground. No cover estimates are required. Points offer quick and efficient data collection and can be used to estimate cover values with minimal bias and error. However, errors can be caused by plants moving in the wind or sampling poles lowered incorrectly. The points themselves have dimensions and can be considered small quadrats. In theory, if you sampled an infinite number of points in an area, you could measure the exact cover for each plant species. Points are either the end of the sampling pole or the intersection of cross-hairs in a sampling frame.

Cover or ground cover is estimated using individual points or collections of points. Collections of points are sampled either with sampling pins, grouped into a pin frame (typically 10 pins) or cross-hairs grouped into a rectangular sighting frame. When using pin frames, the sampling pole is replaced with a pin. Pins are generally smaller in diameter than a sampling pole so are less prone to sampling error (see below). The pin frame itself helps protect sampling pins from damage. Pin spacing should be determined according to plant species and vegetation patterns. For instance, pins in a collection should not be placed so close together that all pins hit bare ground between clumps of grasses or all fall on one clump of grass. The number of points used determines the percent cover values that can be estimated. For example, if 50 points are sampled along a transect, then cover can be estimated in 2 percent intervals (1/50, 2/50, and so forth) for that transect. Cover is estimated by counting the number of "hits" per species or ground cover category divided by total number of points measured. More than one species may be tallied for each pin location depending on project objectives.

Sampling pole and pin diameter can influence the accuracy of cover estimates. This is mostly an issue with large diameter sampling poles, which overestimate cover, especially for narrow or small-leafed species. Pins less than 0.1 inch (2.5 mm) are impractical in the field because they move in the wind and are easily damaged (Bonham 1989). Overestimation of cover is not a problem if the monitoring objective is to note relative cover changes rather than absolute change in cover. Because of the effect of sampling pole and pin diameter on cover estimations, it is necessary to always use the same diameter poles or pins when remeasuring cover.

Point Sampling Techniques

Single points

Each sample point is defined by a sampling pole guided vertically to the ground. We recommend using a sturdy 0.25 inch (0.635 cm) diameter sampling pole when sampling with the FIREMON PO method. Smaller diameter poles (0.125 inch, 0.3175 cm) may be used for more precise measurements and less observer decisions. However, thin poles are more flexible, require more finesse to place in a straight line, and are easily bent in the field. A fiberglass tent pole, wooden dowel, or aluminum rod could all be used as a sampling pole. It should be longer than the vegetation that will be sampled is tall and long enough that field crews can sample without leaning over (40 inches, 100 cm), sharpened on one end with a loop or bend on the other.

Individual points placed at systematic intervals along a transect can give a more precise cover estimate than points grouped into point frames or grid frames, given the same number of points are sampled (Blackman 1935; Goodall 1952; Greig-Smith 1983). Using individual points requires approximately one-third the number of points than using points in groups (Bonham 1989). The distance between systematically located pins along a transect depends on plant size, plant distribution, and the distance between plants. The recommended FIREMON PO sampling method uses the single point sampling approach.

Point frame

Point frames are more practical and more commonly used than grid frames. Point frames are built using wood or metal and consist of two legs and two cross arms, typically containing 10 pins (fig. PO-1). The pins can be made of any material as long as they are relatively small diameter (0.25 inch, 0.635 cm), rigid enough not to bend or break, and long enough to touch the ground.

When sampling, the pins are lowered to the ground cover through the holes and the interceptions are tallied. The size of the frame needs to be designed to suit local vegetation conditions because plant height and distribution patterns affect the spacing of pins and height of the frame. In vegetation types with large plants or clumped distributions, groups of points may intercept plants more frequently with more hits per frame, resulting in an overestimation of cover. Some point frames are built to allow the pins to be slid at an angle into the vegetation, and this can have some sampling benefits in certain types of vegetation. FIREMON provides an alternative data entry form and data entry software to accommodate data gathered with the point frame method. See the section on **User-Specific PO Sampling Design** for more details. See **How to Construct Point Frames and Grid Frames** in the **How-To Guide** chapter for more information.

Grid quadrat frame

A grid frame is made from metal or wood. Rows of thin wire or light string are attached to the inside vertical and horizontal pieces of the frame resulting in a number of intersections or "cross-hairs." Cross-hairs of a grid quadrat are considered point quadrats, and the vertical interception of cross-hairs with plant parts are considered hits. A double grid of cross-hairs prevents error due to observers viewing the cross-hairs at different angles (fig. PO-2).

Stanton (1960) designed a grid frame for estimating cover shrub in communities. This grid of cross-hairs consisted of 25 points spaced 2.95 inches (7.5 cm) apart and was supported with metal legs. This type of frame is good for measuring cover up to 4.5 ft (1.5 m) tall in sparse vegetation. FIREMON provides a data entry form and data entry software to accommodate data gathered with the grid quadrat frame method. See the section on **User-Specific PO Sampling Design** for more details.

There are a number of ways to streamline or customize the PO sampling method. The FIREMON three-tier sampling design can be employed to optimize sampling efficiency. See the sections on **User-Specific PO Sampling Design** and **Sampling Design Customization** below.

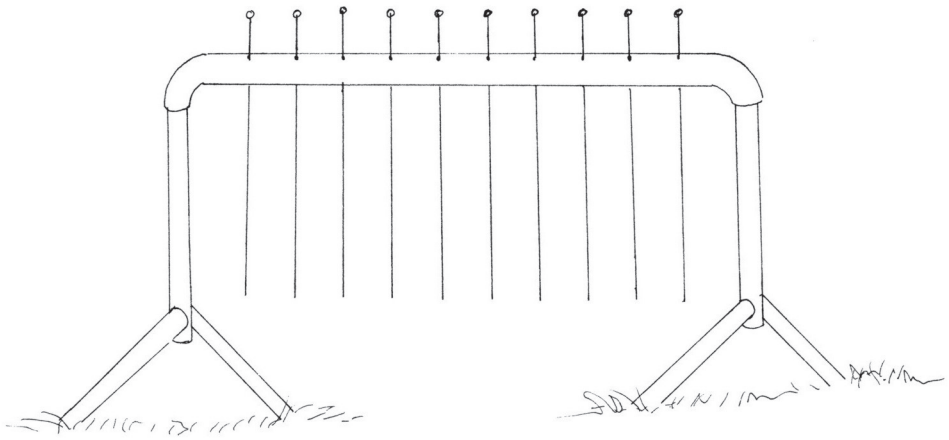

Figure PO-1—Example of a point frame with 10 pins.

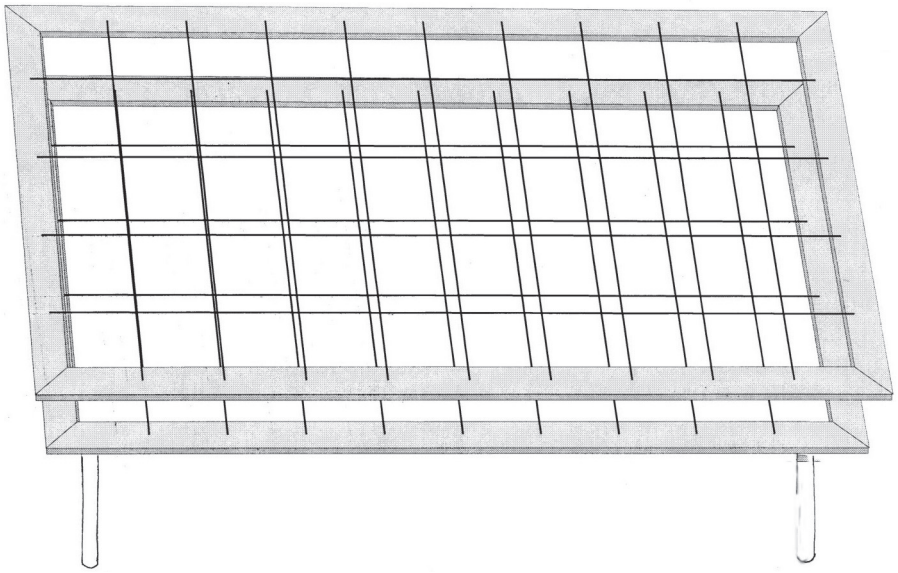

Figure PO-2—Example of a grid frame with 36 points (4 x 9).

SAMPLING PROCEDURE

This method assumes that the sampling strategy has already been selected and the macroplot has already been located. If this is not the case, then refer to the FIREMON **Integrated Sampling Strategy** and for further details.

The sampling procedure is described in the order of the fields that need to be completed on the **PO Transect data form**, so it is best to reference the data form when reading this section. The sampling procedure described here is the recommended procedure for this method. Later sections will describe how the FIREMON three-tier sampling design can be used to modify the recommended procedure to match resources, funding, and time constraints.

In the **How-To Guide** chapter, see **How To Locate a FIREMON Plot**, **How To Permanently Establish a FIREMON Plot,** and **How to Define the Boundaries of a Macroplot** for more information on setting up your macroplot.

Preliminary Sampling Tasks

Before setting out for your field sampling, lay out a practice area with easy access. Try to locate an area with the same species or vegetation life form you plan on sampling. Get familiar with the plot layout and the data that will be collected. This will give you a chance to assess the method and will help you think about problems that might be encountered in the field. For example, will you be recording the plant status—dead or alive—for the part of the plant hit by the sampling pin or the entire plant? It is better to answer these questions before the sampling begins so that you are not wasting time in the field. This will also let you see if there are any pieces of equipment that will need to be ordered.

Many preparations must be made before proceeding into the field for PO sampling. First, all equipment and supplies in the **PO Equipment List** must be purchased and packed for transport into the field. Travel to FIREMON plots is usually by foot, so it is important that supplies and equipment be placed in a comfortable daypack or backpack. It is also important that there be spares of each piece of equipment so that an entire day of sampling is not lost if something breaks. Spare equipment can be stored in the vehicle rather than the backpack. Be sure that all equipment is well maintained and there are plenty of extra supplies, such as data forms, map cases, and pencils.

All PO data forms should be copied onto waterproof paper because inclement weather can easily destroy valuable data recorded on standard paper. Data forms should be transported into the field using a

plastic, waterproof map protector or plastic bag. The day's sample forms should always be stored in a dry place (office or vehicle) and not be taken back into the field for the next day's sampling.

We recommend that one person on the field crew, preferably the crew boss, have a waterproof, lined field notebook for recording logistic and procedural problems encountered during sampling. This helps with future remeasurements and future field campaigns. All comments and details not documented in the FIREMON sampling methods should be written in this notebook.

It is beneficial to have plot locations for several days of work in advance in case something happens, such as if the road to one set of plots is washed out by flooding. Plots should be referenced on maps and aerial photos using pin-pricks or dots to make navigation easy for the crew and to provide a check of the georeferenced coordinates. We found that it is easy to transpose UTM coordinate digits when recording georeferenced positions on the plot sheet, so marked maps can help identify any erroneous plot positions. If possible, the spatial coordinates should be provided if FIREMON plots were randomly located.

A field crew of two people is probably the most efficient for implementation of the PO sampling method. There should never be a one-person field crew for safety reasons, and any more than two people will probably result in part of the crew waiting for tasks to be completed and unnecessary trampling on the FIREMON macroplot. The crew boss is responsible for all sampling logistics including the vehicle, plot directions, equipment, supplies, and safety. The crew boss should be the note taker and the technician should perform most quadrat measurements. The initial sampling tasks of the field crew should be assigned based on field experience, physical capacity, and sampling efficiency. As the field crew gains experience, switch tasks so that the entire crew is familiar with the different sampling responsibilities and to limit monotony.

Designing the PO Sampling Method

A set of general criteria recorded on the PO data form allows the user to customize the design of the PO sampling method so that the sampling captures the information needed to successfully complete the management objective within time, money, and personnel constraints. These general fields should be decided before the crews go into the field and should reflect a thoughtful analysis of the expected problems and challenges in the fire monitoring project. However, some of these fields, in particular the number of points per transect and number of transects, might be adjusted after preliminary sampling is conducted in the field to determine a sufficient sample size.

Plot ID construction

A unique plot identifier must be entered on the PO sampling form. This is the same plot identifier used to describe general plot characteristics in the Plot Description or PD sampling method. Details on constructing a unique plot identifier are discussed in the **How to Construct a Unique Plot Identifier** section in the **How-To Guide** chapter. Enter the plot identifier at the top of the PO data form.

Determining sample size

The size of the macroplot ultimately determines the length of the transects and the length of the baseline along which the transects are placed. The amount of variation in plant species composition and distribution determines the number and length of transects and the number of quadrats required for sampling. The typical macroplot sampled in the PO method is a 0.10 acre (0.04 ha) square measuring 66 x 66 ft (20 x 20 m), which is sufficient for most monitoring applications. If you are not sure of the plot size to use, contact someone wo has sampled the same vegetation that you will be sampling. The size of the macroplot may be adjusted to accommodate different numbers and lengths of transects, and number of points per transect. It is more efficient if you use the same plot size for all FIREMON sampling methods on the plot.

The sampling unit for Point Intercept is the transect. We recommend sampling five transects within the macroplot. However, there are situations when more transects should be sampled. See **How To Determine Sample Size** in the **How-To Guide** chapter for more details. Enter the number of

transects in Field 1 on the PO Transect data form. The recommended transect length is 66 ft (20 m) for a 66 x 66 ft (20 x 20 m) macroplot. However, the macroplot size may be adjusted to accommodate longer or shorter transects based on the variability in plant species composition and distribution. For example, transects may be lengthened to accommodate more points per transect or more widely spaced points. Enter the transect length in Field 2 of the PO Transect data form. The FIREMON PO data form and data entry screen allow a maximum of 10 transects.

We recommend that 66 points be placed 1 ft (0.3 m) apart along each 66-ft (20-m) transect. However, when sampling with a metric tape, we recommend sampling at every 0.25 m for a total of 80 points per transect. The number of points and spacing should be adjusted based on plant species size and spacing. For example, points should not be placed so close together that all sample points hit bare ground between clumps of grasses or all sample points fall on grass clumps. The number of points along a transect determines the resolution of cover recorded. If 50 points are recorded along a transect, cover values can be recorded in increments of 2 percent (1/50, 2/50, and so forth). At a minimum, you want enough points to sample at least some of the species of interest along each transect. Enter the number of points per transect in Field 3 of the PO data form.

Conducting PO Sampling Tasks

Establish the baseline for transects

Once the plot has been monumented, a permanent baseline is set up as a reference from which you will orient all transects. The baseline should be established so that the sampling plots for all of the methods overlap as much as possible. See **How To Establish Plots with Multiple Methods** in the **How-To Guide** chapter. The recommended baseline is 66 ft (20 m) long and is oriented upslope with the 0-ft (0-m) mark at the lower permanent marker and the 66-ft (20-m) mark at the upper marker. On flat areas, the baseline runs from south to north with the 0-ft (0-m) mark on the south end and the 66-ft (20-m) mark on the north end. See **How To Establish a Baseline for Transects** in the **How-To Guide** chapter for more details.

Locating the transects

Transects are placed perpendicular to the baseline and are sampled starting at the baseline. On flat areas, transects are laid out east starting at the baseline. For permanent plots, determine the compass bearing of each transect, record these on the plot layout map and permanently mark each end of the transect. Starting locations for each transect are determined by selecting a sampling scheme using the FIREMON random transect locator or from supplied tables. If the PO method is used in conjunction with other replicated sampling methods (CF, LI, RS, or DE), use the same transects for all methods. In successive remeasurement years, it is essential that transects be placed in the same location. See **How To Locate Transects and Quadrats** in the **How-To Guide** chapter for more details.

Sampling points

Points are sampled at equal intervals along the length of a transect by lowering the sampling pole vertically to the ground, not perpendicular to the slope (fig. PO-3). If 66 points are sampled along a 66-ft transect, the first point is recorded at 1 ft, then every foot to the end of the tape. If 80 points are sampled at 0.25 m along a 20-m transect, the first point is sampled at 0.25 m and the last point at 20 m.

Point Intercept Sampling

Recording hits

The FIREMON PO method may be used to sample just species cover, just ground cover, or species and ground cover together. If the sampling crew is collecting species cover data, record only the plant species that are “hit” by the sampling pole. FIREMON provides plant species codes from the NRCS Plants database. However, local or customized plant species codes are allowed in FIREMON. See **Populating**

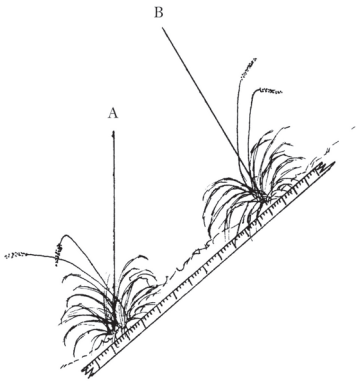

Figure PO-3—Points are sampled by lowering the pin vertically to the ground (point A) and not perpendicular to the slope (point B).

the Plant Species Codes Lookup Table in the **FIREMON Database User Manual** for more details. When using the PO method to sample species cover in clumped or sparse vegetation, you may find that data are only recorded at a subset of the sampling locations because there may not be vegetation at every point that is sampled. If ground cover is being sampled, use the cover codes in table PO-1 to record sampling hits. Unlike species sampling, every point should have a ground cover code recorded. If species and ground cover are being sampled at the same time, record the species name for the plant that the pole hits and the appropriate ground cover code from table PO-1 (fig. PO-4). For instance, if you are lowering a sampling pole and it first contacts a blade of blue grama grass and then, as you continue to lower, it hits the basal portion of the plant, record the NRCS species code, (BOGR2) and the ground cover code (BAGR or BAVE). Enter the plant species and ground cover code in Field 4 on the PO Transect data form.

The number of hits that are recorded for each sampling point is dependent on the project objectives. If the objective is just to monitor ground cover, samplers need to record only the ground cover hits. To develop a complete species list, samplers should record all unique species hits at each sampling point. Multiple hits for each species can be recorded if measuring biomass, volume, or species composition. Again, this is important information to be recorded in the Metadata table.

Table PO-1—FIREMON ground cover codes

Ground cover			
Code	**Description**	**Code**	**Description**
ASH	Ash (organic, from fire)	LICH	Lichen
BAFO	Basal forb	LITT	Litter and duff
BAGR	Basal graminoid	MEGR	Medium gravel (5–20 mm)
BARE	Bare soil (soil particles <2 mm)	MOSS	Moss
BARR	Barren	PAVE	Pavement
BASH	Basal shrub	PEIC	Permanent ie
BATR	Basal tree	PEIS	Permanent ice and snow
BAVE	Basal vegetation	PESN	Permanent snow
BEDR	Bedrock	ROAD	Road
BOUL	Boulders (round and flat)	ROBO	Round boulder (>600 mm)
CHAN	Channers (2–150 mm long)	ROCK	Rock
CHAR	Char	ROST	Round stone (250–600 mm)
CML	Cryptogams, mosses and lichens	STON	Stones (round and flat)
COBB	Cobbles (75–250 mm)	TEPH	Tephra volcanic
COGR	Coarse gravel (20–75 mm)	TRIC	Transient ice
CRYP	Cryptogamic crust	TRIS	Transient ice and snow
DEVP	Developed Land	TRSN	Transient snow
FIGR	Fine gravel (2–5 mm)	UNKN	Unknown
FLAG	Flag stones (150–380 mm long)	WATE	Water
FLBO	Flat boulders (>600 mm long)	WOOD	Wood
FLST	Flat stone (380–600 mm long)	X	Did not assess
GRAV	Gravel (2–75 mm)		

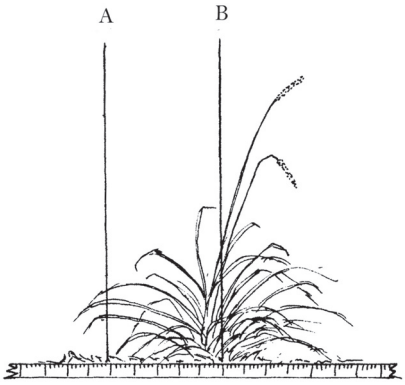

Figure PO-4—If the sampling pole eventually hits ground instead of the basal portion of the plant, then the appropriate ground cover code is recorded, even if it intercepts the aerial portion of the plant (A). Basal vegetation is recorded for ground cover when the pin hits the basal portion of the plant (B).

The angle of the sampling pole has an effect on cover estimates. Vertically lowered sampling poles hit flat bladed species (forbs) more often than grasses. A pole lowered at an angle tends to favor grasses (Winkworth 1955). Most cover measurements use vertical placement of poles but will underestimate narrow leafed species (such as grasses). Other angles are used to increase the number of hits. However, angled sampling eliminates the intuitive visualization of vegetation on to the ground. In FIREMON we recommend using the vertical orientation of the sampling pole. The angle used in sampling should be entered in the FIREMON Metadata table so that data collected in subsequent visits is compatible—especially if some orientation other than vertical pole placement is used for point sampling.

At each interval, lower the sampling pin to the ground and record one hit for each plant species that touches the pole. Record only one hit for each plant species, even if the pole touches the same plant or plant species more than once (fig. PO-5). When measuring ground cover you will generally record only the first or upper most hit. For instance, if the pin passes through an ash layer to bare soil, record only the ash layer.

Tally the "hits" for each species using a dot tally in the workspace column for each transect on the PO Transect data form. See **How to Dot Tally** in the **How-To Guide** chapter for more details. Enter the total number of hits for each species or ground cover class, by transect, in the HITS field on the PO Transect data form.

Recording plant status

Next enter the plant species status in Field 5 on the PO Transect data form. Status describes the general health of the plant species as live or dead using the following codes:

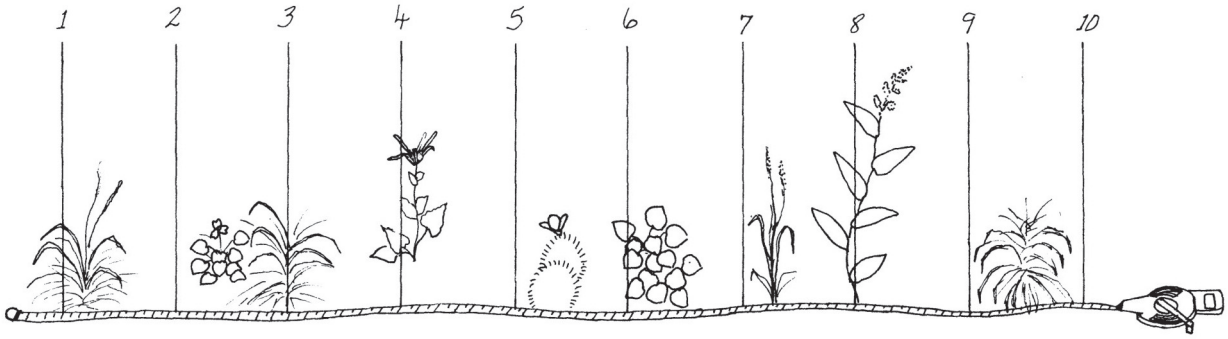

Figure PO-5—In this illustration points 1, 3, 4, 6, and 8 intersect plants and are recorded as "hits" for each species. Points 2, 5, 9, and 10 "miss" plants and are only recorded if ground cover is being sampled. Samplers will usually record just the first ground cover hit at each sampling point.

L—Live: plant with living tissue.

D—Dead: plant with no living tissue visible.

NA—Not Applicable.

This may be an evaluation of the entire plant or just the part of the plant that comes in contact with the sampling pole depending on the project objectives. In FIREMON we recommend recording the status of the plant part that touches the sampling pole. Recognize that an accurate assessment of plant status may be difficult during the dormant season.

Plant status is purely qualitative, but it provides an adequate characteristic for stratification of preburn plant health and determining postburn survival.

Estimating average height

At the end of each transect, estimate the average height of each plant species you tallied, in feet (m) within +/– 10 percent of the mean plant height. This is not the height above the ground where the sampling pole touches the vegetation, but rather the average total height of the plants that are tallied. See **How to Measure Plant Height** in the **How-To Guide** chapter for more details. Enter plant height in the Height field for each transect.

Precision Standards

Use the precision standards listed in table PO-2 for the PO sampling.

SAMPLING DESIGN CUSTOMIZATION

This section presents several ways that the PO sampling method can be modified to collect more detailed information or streamlined to collect only the most important tree characteristics. First, the suggested or recommended sample design is detailed, then modifications are presented.

Recommended PO Sampling Design

The recommended PO sampling design follows the Alternative FIREMON sampling intensity and is listed below:

Macroplot Size: 0.1 acre, 66 x 66 ft (400 m^2, 20 x 20 m).

Number of Transects: 5.

Number of Points per Transect: 66 per 66 ft transect or 80 per 20 m transect, vertically oriented.

The number of transects sampled should be adjusted according to the appropriate methods in the **How-To Guide** chapter of the FIREMON manual. The number of points per transect should be adjusted based on plant species size and spacing.

Collect plant species cover data and ground cover data.

Table PO-2—Precision guidelines for PO sampling.

Component	Standard
Hits	±3 percent total hits
Height	±10 percent average height

Streamlined PO Sampling Design

The streamlined PO sampling design follows the Simple FIREMON sampling intensity and is designed below:

Macroplot Size: 0.1 acre, 66 x 66 ft (400 m^2, 20 x 20 m).

Number of Transects: 3.

Number of Points per Transect: 66 per 66-ft transect or 80 per 20-m transect, vertically oriented.

The number of transects sampled should be adjusted according to the appropriate methods in the **How-To Guide** chapter of the FIREMON manual. The number of points per transect should be adjusted based on plant species size and spacing.

Collect plant species cover and average plant height data.

Comprehensive PO Sampling Design

The comprehensive PO sampling design follows the Detailed FIREMON sampling intensity and is detailed below:

Macroplot Size: 0.1 acre, 66 x 66 ft (400 m^2, 20 x 20 m).

Number of Transects: 5.

Number of Points per Transect: 100 placed at 8-inch intervals on a 66-ft transect or placed at 0.20-m intervals on a 20-m transect, vertically oriented.

The number of transects sampled should be adjusted according to the appropriate methods in the **How-To Guide** chapter of the FIREMON manual. The number of points per transect should be adjusted based on plant species size and spacing.

Collect plant species cover, ground cover, and measure average plant height.

User-Specific PO Sampling Design

There are a number of ways the user can adjust the PO sample fields to make sampling more efficient and meaningful for local situations. Examiners may adjust the number of transects and points per transect based on plant species size and distribution.

Points could be sampled in quadrats or frames placed along a transect rather than using individual points. Collections of points are pins grouped into a pin frame (usually 10 pins) or cross-hairs grouped into a sighting frame. See **How To Construct Point Frames and Grid Frames** in the **How-To Guide** chapter for more details. If 10 pins are used in a frame, percent cover can be estimated within 10 percent intervals (1/10, 2/10 and so forth) for each frame. If the point frames or grid frames are placed far enough apart (they are independent samples), the frames can be the sample units rather than the transects.

The PO method may be used in conjunction with the CF method to sample ground cover by using the CF sampling quadrat as a point frame. A pencil or pen is used to record ground cover "hits" at the four corners and the four midpoints on each side of the quadrat. A total of eight points are recorded for each quadrat.

If grid frames or point frames are being sampled along transects rather than individual points, then determine the number of quadrats or point frames sampled per transect using the methods in **How To Determine Sample Size** in the **How-To Guide** chapter. Record the number of frames per transect in Field 3, the number of points per frame in Field 4, and the transect number in Field 5 on the PO Point Frames data form. The FIREMON data entry screen and database accommodates 20 frames per transect and an unlimited number of transects.

The PO method is typically used for grasses, forbs, and small shrubs less than 3 ft (1 m) in height. However, this method can be modified to sample large shrubs and trees as well. Instead of using pins that drop to the ground or a grid frame that the observer looks down on, you could use a sighting device, such as a sighting tube or "moosehorn," which allows you to look down for small plants and look up into the canopy for larger species.

The type of cover typically estimated by points is total cover. Cover can also be measured within defined vegetation layers, or by different species. If measuring cover, record only the first hit of each pin. Multiple hits for each species can be recorded if measuring biomass, volume, or species composition.

Sampling Hints and Techniques

Examiners must be able to identify plant species, be familiar with ground cover category codes, and know how to collect cover data using a pin. If only ground cover is being sampled, plant identification skills are not required.

Measuring tapes are made from a variety of materials and are available in varying lengths and increments. Examiners should choose English (metric) tapes for this method and select a tape that is at least as long, or a little longer, than the transect length being sampled. Steel tapes do not stretch and are the most accurate over the life of the tape. Steel is probably the best choice for permanent transects where remeasurement in exactly the same place each time is important. Cloth and fiberglass tapes will stretch over the life of the tape but are easier to use than steel tapes because they are lighter and do not tend to kink.

Point intercept cover is easily calculated if 100 points are sampled per transect. Cover values are equal to the number of "hits" for each item on the transect. Metric tapes are easily divided into 100 intervals, and sampling a 20-m tape at 20-cm intervals is relatively simple. However, if sampling with English tapes marked in inches and feet, sampling 100 points is impractical unless the transect length is a multiple of 100 (50, 100, 200). On a 66-ft transect, 100 points must be placed at 8-inch intervals. It is time consuming to place the point at the right mark on the tape. If a high resolution of cover is desired (for example, 1 percent), one solution is to sample along a 66-ft transect at every 0.5 ft for 132 points. Another solution is to increase the transect length to 100 ft, and place a point at every foot. When deciding how many points to sample per transect, it is better to sample more transects than place more points per transect. Sampling with fewer points and more transects will often sample more variability within the plot at a slightly lower resolution of cover (for example, 1/66 = 1.5 percent versus 1/100 = 1 percent).

The sampling crew may encounter an obstacle, such as a large rock or tree, along one of the transect lines that interferes with the quadrat sampling. If that happens, offset using the directions described in **How To Offset a Transect** in the **How-To Guide** chapter.

When entering data on the PO Transect data forms, examiners will most likely run out of space on the first page. The form was designed to print one copy of the first page, and several copies of the second page. The second page can be used to record more plant species on the first three transects or to record data for additional transects. The second page of the data form allows the examiner to write the transect number on the form. This allows the examiner to design the form to accommodate the number of transects sampled. Print out enough pages to record all species on all transects for the required number of intercepts. The FIREMON data entry screens and database allow a maximum of 10 transects.

When entering data on the PO Point Frames data forms, examiners will most likely run out of space on the first page. As with the PO Transect form, the Frame form was designed to print one copy of the first page and several copies of the second page. The second page can be used to record more plant species on the first five point frames or to record data for additional frames. The second page of the data form allows the examiner to write the frame number on the form. This allows the examiner to design the form to accommodate the number of frames sampled per transect. Print out enough pages to record all species on all transects for the required number of intercepts. The FIREMON PO data entry screens and database allow a maximum of 20 transects per plot.

POINT INTERCEPT (PO) FIELD DESCRIPTIONS

Transect Form

Field 1: **Number of Transects**. Total number of transects on the plot.

Field 2: **Transect Length.** Length of transect (ft/m).

Field 3: **Number of Points per Transect**. Number of points sampled per transect.

Field 4: **Item Code**. Code of sampled entity. Either the NRCS plants species code, local code for that species, ground cover code, or other item code.

Field 5: **Status**: Plant status—Live, Dead, or Not Applicable. (L, D, NA). Precision: No error.

Hits. Enter the total number of hits for the item on the transect. Precision: ±3 percent of total

Average Height. Enter the average height for each plant species or life-form on the transect (ft/m). Precision: ±10 percent mean height.

Point Frame Form

Field 1: **Number of Transects**. Total number of transects on the plot.

Field 2: **Transect Length**. Length of transect (ft/m).

Field 3: **Number of Frames per Transect**. Number of frames sampled per transect.

Field 4: **Number of Points per Frame**. Number of points sampled per frame.

Field 5: **Transect Number**. Sequential number of the sample transect.

Field 6: **Item Code**. Code of sampled entity. Either the NRCS plants species code, local code for that species, ground cover code, or other item code.

Field 7: **Status**: Plant status—Live, Dead, or Not Applicable. (L, D, NA). Precision: No error.

Hits. Enter the total number of hits for the item in the frame. Precision: ±3 percent of total.

Average Height. Enter the average height for each plant species or life-form in the frame (ft/m). Precision: ±10 percent mean height.

FIREMON PO Cheat Sheet

Ground cover codes

Ground cover			
Code	**Description**	**Code**	**Description**
ASH	Ash (organic, from fire)	LICH	Lichen
BAFO	Basal forb	LITT	Litter and duff
BAGR	Basal graminoid	MEGR	Medium gravel (5–20 mm)
BARE	Bare soil (soil particles <2 mm)	MOSS	Moss
BARR	Barren	PAVE	Pavement
BASH	Basal shrub	PEIC	Permanent ie
BATR	Basal tree	PEIS	Permanent ice and snow
BAVE	Basal vegetation	PESN	Permanent snow
BEDR	Bedrock	ROAD	Road
BOUL	Boulders (round and flat)	ROBO	Round boulder (>600 mm)
CHAN	Channers (2–150 mm long)	ROCK	Rock
CHAR	Char	ROST	Round stone (250–600 mm)
CML	Cryptogams, mosses and lichens	STON	Stones (round and flat)
COBB	Cobbles (75–250 mm)	TEPH	Tephra volcanic
COGR	Coarse gravel (20–75 mm)	TRIC	Transient ice
CRYP	Cryptogamic crust	TRIS	Transient ice and snow
DEVP	Developed Land	TRSN	Transient snow
FIGR	Fine gravel (2–5 mm)	UNKN	Unknown
FLAG	Flag stones (150–380 mm long)	WATE	Water
FLBO	Flat boulders (>600 mm long)	WOOD	Wood
FLST	Flat stone (380–600 mm long)	X	Did not assess
GRAV	Gravel (2–75 mm)		

Point cover (PO) equipment list

Camera with film	Maps, charts and directions
PO data forms	Map protector or plastic bag
Clipboard	Magnifying glass
Compass	Pocket calculator
File	Point frame (pn or grid) (optional)
Field notebook	Pole—0.25 inch diameter
Graph paper	Plot sheet protector or plastic bag
Hammer	Rebar stakes (2) for baseline plus 2 for each transect
Indelible ink pen (Sharpie, Marker)	Steel fence post (2) and driver (to mark endpoints of baseline)
Lead pencils with lead refills	Tape 75 ft (25 m) or longer (2)

Precision

Component	Standard
Cover	±1 class
NRF	No error
Height	± 10 percent

Status codes

Code	Description
L	Live
D	Dead
NA	Not applicable

Canopy cover classes

Code	Cover
	Percent
0	Zero
0.5	>0–1
3	>1–5
10	>5–15
20	>15–25
30	>25–35
40	>35–45
50	>45–55
60	>55–65
70	>65–75
80	>75–85
90	>85–95
98	>95–100

Point Intercept (PO) Form

Transects

Field 1	Field 2	Field 3
Number of Transects	Transect Length	Number of Pts./Tran.

Plot Key

RegistrationID: _ _ _ _

ProjectID: _ _ _ _ _ _ _ _

PlotID: _ _ _

Date: _ _/_ _/_ _ _ _

PO Page _ _ of _ _

Field 4	Field 5	Transect 1		Transect 2		Transect 3		Transect 4		Transect 5	
Item Code	Status	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)
Dot Tally Space →											

Notes:

Crew:

Point Intercept (PO) Form

Transect continuation

Field 1	Field 2	Field 3
Number of Transects	Transect Length	Number of Pts./Tran.

Plot Key

RegistrationID: _ _ _ _

ProjectID: _ _ _ _ _ _ _ _ _

PlotID: _ _ _

Date: _ _/_ _/_ _ _ _

PO Page _ _ of _ _

Field 4	Field 5	Transect _		Transect _		Transect _		Transect _		Transect _	
Item Code	Status	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)
Dot Tally Space →											

Notes:

Crew:

Point Intercept (PO) Form

Point Frames

Field 1	Field 2	Field 3	Field 4
Number of Transects	Transect Length	Number of Frames/Trans	Number of Pts./Frame

Plot Key

RegistrationID: _ _ _ _

ProjectID: _ _ _ _ _ _ _ _ _

PlotID: _ _ _

Date: _ _/_ _/_ _ _ _

PO Page _ _ of _ _

Field 5	Field 6	Field 7	Frame 1		Frame 2		Frame 3		Frame 4		Frame 5	
Transect Number	Item Code	Status	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)
Dot Tally Space →												

Notes:

Crew:

Point Intercept (PO) Form
Point Frames Continuation

Field 1	Field 2	Field 3	Field 4
Number of Transects	Transect Length	Number of Frames/Trans	Number of Pts./Frame

Plot Key

RegistrationID: _ _ _ _
ProjectID: _ _ _ _ _ _ _ _ _
PlotID: _ _ _
Date: _ _/_ _/_ _ _ _

PO Page _ _ of _ _

Field 5	Field 6	Field 7	Frame _		Frame _		Frame _		Frame _		Frame _	
Transect Number	Item Code	Status	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)	Hits	Height (ft/m)
Dot Tally Space →												

Notes:

Crew: